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## SCIENTIFIC BOOKS

*Gruppenweise Artbildung.* By HUGO DE VRIES, Professor of Botany in Amsterdam. Berlin, 1913. Verlag von Gebrüder Borntraeger. Pp. viii + 365. Figs. 121. Colored plates 22. Price 24 marks.

Somewhat more than ten years has passed since the appearance of the first volume of "Die Mutationstheorie" and we are most fortunate to have from Professor De Vries another book that is an extension of the former discussion and that also brings forward a remarkable body of new observations of very great interest to the workers in genetics. It is not often that an investigator is able to follow an earlier work of the scope of "Die Mutationstheorie" with a book of as great import, yet we have in "Gruppenweise Artbildung" a volume that perhaps outranks the first contribution in matter and in exposition. It will surprise even the students of *Oenothera* to note the remarkably wide range of crosses among these forms that De Vries has made and the extraordinary mass of observations that he has accumulated. These are carefully indexed and readily accessible for reference.

The first part deals with the origin of species by mutation. This is a summary of the views developed in "Die Mutationstheorie" with De Vries's answers to various criticisms that have been expressed to about the year 1912. There has been no essential change in his interpretation of the "mutations" from *Oenothera Lamarckiana*, an explanation of which is offered by a somewhat more detailed statement of his theory of intracellular pangensis. Pangens are assumed in any individual to be in an active, inactive or labile state, and mutations arise when they are in the labile condition.

As to the status of *Oenothera Lamarckiana*, De Vries stands by his original position. It is to him representative of a wild species of American origin. Papers of the reviewer concerning the identity of Lamarck's plant of 1796 and on the problem of the origin of the *Lamarckiana* of De Vries's cultures have appeared too recently to find a

place in his discussion, and probably for the same reason there is no discussion of the studies of Heribert-Nilsson. De Vries takes a clear position against the view that the "mutants" of *Lamarckiana* represent the splitting of a hybrid form. He believes that hybrids between species of *Oenothera* breed true as illustrated by his reported observations on the cross between *biennis* and *muricata*. When an *Oenothera* cross gives a wide range of variants in an  $F_2$  generation, as in the case of the hybrids between *grandiflora* and American types of *biennis*, De Vries apparently assumes that a mutating habit has descended from one or both of the parents.

Part two, treating of reciprocal and double reciprocal crosses, gives in detail the data upon which the conclusions reported by De Vries in 1911 were based. *Oenothera biennis* and *O. muricata* of Holland are two well-defined species, readily distinguishable, which breed true. Their reciprocal hybrids exhibit constant and marked differences and in the most striking of their vegetative characters strongly resemble the pollen parent. So uniform is this behavior that De Vries expresses the results with respect to the characters concerned by two formulæ— $b \times m = m$ , and  $m \times b = b$ . The important peculiarity of these hybrids is then the fact that they differ sharply from one another to a degree very unusual in reciprocal crosses. Furthermore, the reciprocals are reported to breed true without exhibiting variation in the  $F_2$  generation as might be expected.

These reciprocal crosses may be crossed with one another in two ways to give double reciprocals— $(biennis \times muricata) \times (muricata \times biennis)$ , and  $(muricata \times biennis) \times (biennis \times muricata)$ . When this is done the contrasted characters of the parent type which occupies the center of the formula appear to drop out and the resulting double reciprocal hybrid presents the characters of the parent which occupies the peripheral position. Expressed in simple formulæ, which only apply to the vegetative characters under consideration— $(b \times m) \times (m \times b) = b$ , and  $(m \times b) \times (b \times m) = m$ . The products of the double

reciprocal crosses, like the reciprocals, also breed true.

Modifications of the double reciprocal crosses, termed by De Vries sesquireciprocals, may be made by combinations of the reciprocals with the parents in such a manner that similar parent types occupy the periphery of the formulæ— $b \times (m \times b) = b$ ,  $(b \times m) \times b = b$ ,  $m \times (b \times m) = m$ , and  $(m \times b) \times m = m$ . Other arrangements with the peripheral positions of the formulæ occupied by different parent types give iterative hybrids— $b \times (b \times m) = m$ ,  $(m \times b) \times b = b$ ,  $m \times (m \times b) = b$ , and  $(b \times m) \times m = m$ .

The explanation of this remarkable behavior is not as yet determined. An attractive hypothesis postulates the differentiation of classes of gametes carrying the characters of the parents in pure form and their appropriate combinations either by selective fertilization or through the elimination of such gametes as do not fit into the assumed schemes of combination. But these and other speculations must await the results of cytological studies as well as further experimentation. An interesting peculiarity of these crosses is their very high degree of sterility and it remains to be seen whether the same phenomena will be found in other *Oenothera* species crosses that are more fertile. Thus it is possible that numerous and varied types of gametes may be developed by the hybrids, as theoretically would be expected, but that physiological conditions will allow only certain types to mature or function.

A long and detailed account of twin hybrids constitutes the third part. These classes of hybrids were first discovered by De Vries among hybrids of *Lamarckiana* with other species of *Oenothera*. He has since greatly extended his observations and finds twin hybrids also differentiated when certain "mutants" from *Lamarckiana* are similarly crossed (e. g., *nanella*, *lata*, *scintillans*, *oblonga* and also *lævifolia*). *Brevistylis* in such crosses follows a Mendelian ratio and *gigas* gives intermediate hybrids. The twin hybrids appear in the first hybrid generation which consists of two sharply contrasted groups. In

one group, termed *læta*, the characters of *Lamarckiana* are strongly dominant over those of the other parent. In the other group, termed *velutina*, the characters of the other parent dominate those of *Lamarckiana*. The proportions of the *læta* and *velutina* types appear to vary greatly in different cultures. The *velutina* types breed true in the second and later generations, but the *læta* forms were found in certain cultures to split off new lines of *velutina* in successive generations.

Another pair of twin hybrids, very different from *læta* and *velutina*, are distinguished as *densa* and *laxa*. They appear in crosses between certain broad-leaved forms of American *biennis* and *cruciata* with *Lamarckiana* or its "mutants." The distinctions here concern chiefly the form of the foliage and the number of capsules over a given length of stem; *densa* is broad-leaved with thickly crowded capsules, *laxa* has smaller leaves and capsules less numerous. The *densa* type breeds true, the *laxa* throws off in successive generations still another form, *atra*, distinguished by dark green leaves.

With the twin hybrids may be found a class of delicate and dwarfed plants, the seedlings of which are etiolated. These are named *gracilis* and they are present in very diverse proportions. Very many of the *gracilis* types die as seedlings, a few with care may be brought to maturity as narrow-leaved plants mostly sterile. The classes of dwarfs that the writer has reported for a number of crosses between *grandiflora* and American *biennis* may correspond to this group. Finally among the twin hybrids are occasionally found plants of marked size or luxuriance which appear to hold to the cultures as a whole a relation somewhat similar to that of *gigas* or *semi-gigas* to *Lamarckiana*. This type is called *hero*.

De Vries offers an explanation of twin hybrids, and of the *gracilis* and *hero* types through his theory of mutation and intracellular pangenesis. Mendelians may attempt to find in the phenomena the results of recombinations of multiple factors, although they will have difficulties in working out consistent

ratios. Others may be satisfied with an elastic view that allows of profound interactions of factors upon one another with their material modification in the "melting pot of cross breeding."

The lengthy fourth part is an examination of the chief new species of De Vries's cultures as to their behavior in crosses, with special reference to an explanation of this behavior on the theory of intracellular pangensis. An immense amount of detail is presented, well sifted, however, by the summary and conclusions. It is interesting to note that of these new species *gigas* alone is considered as progressive; *brevistylis*, *rubrinervis* and *nanella* are regarded as retrogressive, *lata* and *scintillans* as degressive, and *oblonga* as anomalous.

Finally a fifth part on the cause of mutation gives us the latest statement of De Vries's position. This part consists of discussions of a number of topics related to other portions of the book or to earlier publications of the author, and constitutes a general summary. "Gruppenweise Artbildung" results from a gradual accumulation of mutations on the part of a species, and hybridization to De Vries includes a very much wider range of phenomena than the types interpreted by Mendelian analysis.

A comprehensive bibliography of *Oenothera* experimental literature, a full and very valuable citation of the crosses that De Vries has personally made among the *Oenotheras*, and an excellent index complete the volume. The 121 text-figures throughout the book are of an unusually high grade, and the 22 colored plates admirably executed. It is greatly to be hoped that the author and publisher will promptly arrange for an English translation.

BRADLEY M. DAVIS

*Monographia Uredinearum seu specierum omnium ad hunc usque diem cognitarum descriptio et adumbratio systematica.* By P. and H. Sydow. Volumen III., Fasciculus I.: Pucciniaceæ, cum 7 tabulis. Lipsiæ, Fratres Bornträger. 1912. 8vo. Pp. 1-192.

The appearance of the first part of the third volume of the "Monographia Uredinearum" by P. and H. Sydow has been of especial interest to mycologists because it has given the first bit of information concerning the classification which the authors are following, or propose to follow, in this work. The two earlier volumes (Vol. I., Genus *Puccinia*, 1902-4; Vol. II., Genus *Uromyces*, 1910) were entirely taken up with the treatment of two genera, *Puccinia* and *Uromyces*, without the slightest hint as to how they were to fit into any general arrangement. It seemed evident from the beginning that these two genera were given preferences on account of their size and popular importance and not because they might appear in that order in any scheme of classification. The correctness of this surmise is now well shown. The third volume is begun with a key to the genera of the family Pucciniaceæ, a total of twenty-five being recognized. In this key *Uromyces* is number 8 and *Puccinia* number 10. In the preparation of a work of this nature there are many obvious advantages in not being hampered by the publication of a key at the start, before all of the genera are fully studied, which must thereafter serve as a guide. The freedom with which these authors began their task they have deliberately relinquished, for they are herewith publishing a key to twenty-five genera although the descriptive accounts to date only cover fully the first sixteen of them.

To do the monographic work first and follow it with a key will, however, evidently not succeed in eliminating difficulties, as is evidenced by an examination of the present part. For example, one finds that the genera *Uropyxis* and *Diorchidium* are recognized in the key as valid, although they have been treated already in previous parts as synonymous with *Puccinia*. With the exception of these four genera, which have been treated previously, the present part takes up the genera in the order of the key and proceeds as far as the generic description of *Uromycladium*, which is the sixteenth genus.

The genera in the order of their appearance are as follows, *Gymnosporangium*, *Hamasopra*,